

**WHAT IS CLAIMED IS:**

- 1        1. An apparatus for monitoring the functionality of an optical element comprising:  
2            a detector; and  
3            a light source whose radiation is reflected to the detector by a surface of the optical  
4 element facing the detector and the light source.
- 1        2. The apparatus of claim 1, wherein the light source is arranged to direct radiation to  
2 the center of the surface of the optical element.
- 1        3. The apparatus of claim 1, wherein the light source and the detector are disposed  
2 laterally to the optical element.
- 1        4. The apparatus of claim 1, wherein the light source and the detector are both disposed  
2 at the same angle to the surface of the optical element.
- 1        5. The apparatus of claim 1, wherein the radiation of the light source is directed to the  
2 surface of the optical element at an angle of less than 30°.
- 1        6. The apparatus of claim 1, wherein the light source and the detector are integrated in a  
2 holder for the optical element.
- 1        7. The apparatus of claim 1, wherein the light source is a light emitting diode and the  
2 detector is a photodiode.
- 1        8. The apparatus of claim 1, further comprising a comparator for comparing a detected  
2 light intensity detected by the detector with a reference intensity.
- 1        9. The apparatus of claim 8, wherein the comparator generates an error signal when the  
2 detected light intensity differs from the reference intensity by a defined value.
- 1        10. The apparatus of claim 1, wherein the optical element comprises zinc selenide.

1 11. The apparatus of claim 1, wherein the optical element comprises gallium arsenide.

1 12. The apparatus of claim 1, wherein the optical element comprises diamond.

1 13. An apparatus for monitoring the functionality of an optical element comprising:

2 a detector; and

3 a light source whose radiation is reflected by a surface of the optical element to the  
4 detector, wherein the surface faces the detector and the light source, wherein the radiation of  
5 the light source is directed to the center of the surface of the optical element, wherein the  
6 light source and the detector are disposed laterally to the optical element, wherein the light  
7 source and the detector are disposed at the same angle to the surface of the optical element,  
8 and wherein the radiation of the light source is directed to the surface of the optical element  
9 at an angle of less than 30°; and

10 a comparator for comparing a light intensity detected by the detector with a reference  
11 intensity and for generating an error signal when the detected light intensity differs from the  
12 reference intensity by a defined value.

1 14. A laser comprising:

2 an optical element;

3 a detector;

4 a light source whose radiation is reflected by a surface of the optical element facing  
5 the detector and the light source to the detector, wherein the light source and the detector are  
6 arranged to monitor the functionality of the optical element.

1 15. The laser of claim 14, wherein the laser is a CO<sub>2</sub> laser.

1 16. The laser of claim 14, wherein the surface is a mirror surface provided in a laser  
2 resonator.

1 17. The laser of claim 16, further comprising a laser resonator, wherein the surface is an  
2 inner side of an output coupler mirror facing the laser resonator.

1        18. The laser of claim 16, wherein the surface is an outer side of an output coupler mirror  
2 facing away from the laser resonator.

1        19. The laser of claim 14, further comprising a comparator for comparing a light  
2 intensity detected by the detector with a reference intensity and generating an error signal  
3 when the detected light intensity differs from the reference intensity by a defined value.

1        20. The laser of claim 19, wherein the error signal causes the laser to be switched off.

1        21. The laser of claim 14, wherein the radiation of the light source is directed to the  
2 center of the surface of the optical element.

1        22. The laser of claim 14, wherein the light source and the detector are disposed laterally  
2 to the optical element.

1        23. The laser of claim 14, wherein the light source and the detector are disposed at the  
2 same angle to the surface of the optical element.

1        24. The laser of claim 14, wherein the radiation of the light source is directed to the  
2 surface of the optical element at an angle of less than 30°.

1        25. The laser of claim 14, wherein the optical element comprises zinc selenide.

1        26. The laser of claim 14, wherein the optical element comprises gallium arsenide.

1        27. The laser of claim 14, wherein the optical element comprises diamond.

1        28. An apparatus for monitoring damage to an optical element of a laser resonator  
2 comprising:

3        a light source whose radiation is reflected by a surface of the optical element;  
4        a detector for detecting radiation emitted from the light source and reflected by the

5 surface of the optical element, wherein the detector is adapted for detecting a characteristic of  
6 the reflected radiation indicative of damage to the optical element.

1 29. The apparatus of claim 28, wherein the radiation of the light source is directed to the  
2 surface of the optical element at an angle of greater than 60° to the normal of the surface of  
3 the optical element.

1 30. The apparatus of claim 28, wherein the light source and the detector are integrated in  
2 a holder for the optical element.

1 31. The apparatus of claim 28, wherein the light source is a light emitting diode and the  
2 detector is a photodiode.

1 32. The apparatus of claim 28, wherein the characteristic of the reflected radiation is an  
2 intensity of the reflected radiation, and further comprising a comparator for comparing the  
3 intensity of the reflected radiation with a reference intensity.

1 33. The apparatus of claim 32, wherein the comparator generates an error signal when  
2 the light intensity of the reflected radiation differs from the reference intensity by a defined  
3 value.

1 34. The apparatus of claim 33, wherein the error signal is used to switch off a laser  
2 whose optical element is monitored by the apparatus.

1 35. A method for monitoring damage to an optical element of a laser resonator, the  
2 method comprising:  
3 shining a light beam onto a surface of the optical element;  
4 detecting an intensity of a reflected portion of the light beam that is reflected by the  
5 optical element; and  
6 comparing the intensity of the reflected portion of the light beam with a reference  
7 intensity.

1        36. The method of claim 35, wherein the light beam is directed to the surface of the  
2        optical element at an angle of greater than 60° to the normal of the surface of the optical  
3        element.

1        37. The method of claim 35, further comprising generating an error signal when the  
2        intensity of the reflected portion of the light beam differs from the reference intensity by a  
3        defined value.

1        38. The method of claim 37, further comprising switching off a laser in response to the  
2        error signal.

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